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elongata Fabr., which was found swarming in numbers, skeletonizing the leaves, and frequently killing the young plants. Mr. Porter stated that he was compelled to replant on account of them.

On a neighboring farm, owned by Mr. Z. Rouch, almost as much damage had been done by the army-worm as on the former place. A large corn-field and a field of timothy were totally ruined. A wheat-field, further advanced than that of Mr. Porter's, was less seriously affected, although it did not escape entirely, the blades of the wheat and the young timothy being entirely eaten up by them. It was on this place that the effects of the worms on barley were seen. Quite a large field already in head was completely ruined.

In the afternoon probably the largest farm in the county was visited, that of the Hon. D. N. Dennis, comprising five hundred acres or more. No better place existed for the proper study of the pest, as the worms were swarming in all the fields by the millions, and it was just the proper time of day to see them most advantageously, four o'clock P.M. The ground was literally black with the crawling worms. Mr. Dennis had made no especial efforts to destroy them, although, like some of his neighbors, he had surrounded some of his fields with ditches in an attempt to keep them out of adjoining fields. It is believed that it would have been quite practicable to have destroyed many thousands with poisonous washes, or, as Mr. Porter did, by burning straw in the ditches, as the bottom of the ditches were black with worms.

This farm is divided by a central lane, on either side of which are fields of wheat, corn, grass, oats, etc.; and in passing through this lane the worms were found quite plentiful, crawling almost invariably in the direction of the prevailing wind.

One of the first fields passed was an immense wheat-field already in the head, and the worms could be plainly discernible on the ground all through it and on the stalks and heads. The worms, having already devoured the young timothy and other tender plants usually found growing there, the blades of the wheat, the husks, and a goodly portion of the kernels, evidently could not find sufficient food, and were now migrating to pastures new, the sides of the field being black with moving hosts seeking more nutritious food.

These, as well as all the others observed, were moving in a southwesterly direction,—the direction of the prevailing wind. They were apparently in all stages of growth, from little fellows not more than a quarter of an inch long, to the fully matured larvæ, and all got over the ground and every obstacle in their way with the most surprising rapidity. The fences, posts, and other obstacles in their way were no obstruction to their migratory instinct or their search for food. The fence-rails and posts were often covered with crawling worms, sometimes not less than a dozen worms being found on the top of a single tall post, while others were seen going up one side as others were going down the opposite. Some specimens were even found under the loose bark on the posts and rails, where they had probably crept for shelter. One specimen thus found was in the jaws of a large hairy spider, *Salicis* sp.

Adjacent to this wheat-field was a large field of timothy, containing seventeen acres, the blades of which had been cut off by the worms as clean as cattle could have done. Mr. Jones, the overseer, said that this field would have harvested not less than three tons of hay to the acre, but that now it would not pay for the cutting.

At one side of this field, the side next the wheat, the worms had congregated in countless numbers, every square foot having not less than thirty to fifty worms. The worms were now coming out of this field and going into the adjoining wheat-field, and crossing the lane into the opposite fields in great numbers; and it was here that a flock of the common English sparrows, and a few robins picking out the smaller worms and feeding on them, were observed. Mr. Jones said that the English sparrows had been thus busily engaged for a whole week, and it is a pleasure to record here this fact in favor of the despised bird.

Some distance off from this field was another one of wheat, containing probably twenty acres, in which the worms were even

more numerous; and they had already sufficiently injured it to render the crop unprofitable to harvest. A deep, broad ditch had been dug along one side, and it was now, about five o'clock P.M., black with worms. It seemed a pity that these worms were not killed, as many of them were able to crawl up the sides, and escape into adjoining fields.

Facing this field was a large corn-field of probably seventy-five acres, of which fifty acres had already been destroyed; and there was but a slight chance that any of the corn still left would escape, although by ditching an effort was being made to save it. Of the fifty acres destroyed, thirty acres had already been replanted; and in the newly ploughed portion the worms were seen moving about in all directions, having just entered it from the adjoining wheat. It is probable that most of these will die of starvation or from the effects of the hot sun in the middle of the day.

Messrs. Hayward and Ashmead were particularly struck with what Professor Riley has written about the army-worm not feeding on clover. Of the several clover-fields they saw, the worms passed entirely through them, eating the timothy, other grasses, and some weeds, but leaving the clover almost untouched. A few of the leaves and some of the heads were slightly eaten, but no appreciable injury was observed. Only once did they actually observe a worm eating it, and that was a single half grown specimen curled up on the head, devouring the most palatable portions.

The present outbreak seems to be quite local, within a radius of ten to fifteen miles; and of the origin and previous outbreaks but little was ascertained. All the farmers and others interviewed concurred in the opinion that the winter of 1889-90 had been unusually mild and dry, and a few reported having observed the worms feeding on warm days during the winter.

On the following day they visited Salisbury, but found nothing of importance to prolong their stay there. Messrs. L. Malone and W. B. Tighlman said that the army-worm had not as yet appeared on any of the farms in the immediate vicinity, and no serious injury had been done nearer than three miles.

Mr. Tighlman reported the oat-crop of this whole region this year a total failure from the depredations of the grain aphis, *Siphonophora avenae* Fabr.

WHEAT-SMUT.

THE August Bulletin of the Kansas Experiment Station contains the report of an exhaustive experiment in the prevention of the stinking-smut of wheat, the results of which are so valuable that they should have the widest possible dissemination.

It is a well-known fact that smut and similar growths are due to parasitic fungi, which propagate by spores (similar to seeds of other plants); these spores being, in the case of wheat-smut, the black stinking-powder that is found inside the smutted grains. In threshing, these grains are broken, and the spores are scattered over healthy grains, with which they are planted and on which they take root and grow, sending up in the tissues of the young plant microscopic threads, which grow with its growth; and when the wheat heads out, they penetrate the grains, and there absorb the nutriment intended for the grain, and convert it into the fetid smut.

Knowing this history of the smut, it is easy to understand that any treatment that will kill the spores of the smut on the seed-grain will reduce the injury to the following crop. It has long been known that this might be accomplished by soaking the seed-grain in solution of sulphate of copper (blue vitriol), but this process has the disadvantage of injuring the vitality of the seed-grain. The Kansas experiment was undertaken with a view of ascertaining whether the desired object might be accomplished without this injury. In this experiment fifty-one different methods of treatment were employed. Some killed the grain as well as smut; some did little or no good. The most effective treatment was found to be simply scalding the seed,—a method first published by J. L. Jensen of Denmark.

To accomplish this, the seed should be handled in loose baskets, such as will permit the water to pass readily through them. It should first be dipped in water warmed to from 110° to 120°,

otherwise the scalding water will be cooled too much; then dip it in a large vessel containing water heated to not less than 132° and not exceeding 135°. Shake or stir it thoroughly, so that the water will reach every grain. Remove the basket occasionally, and add boiling water until the temperature is brought up to the proper point. Keep it in hot water fifteen minutes, then spread out to dry. If this work is thoroughly done, the smut-spores will be destroyed without any injury to the wheat.

DRIED BREWERS' GRAINS.

THE dairymen of our larger cities and towns who live in the neighborhood of large brewing establishments have long recognized refuse brewers' grains as excellent food for milch cattle.

In brewing, says Mr. William Frear, in Bulletin No. 12 of the Pennsylvania State College Agricultural Experiment Station, the barley is first started to germinating, by which most of the starch is changed to maltose, a soluble compound related to sugar. At the proper stage germination is arrested by drying the grains; and the sprouts, which would impart undesirable qualities to the "wort," are removed by stirring and screening. The maltose is then extracted from the grain by hot water to form the wort, or liquid in which alcoholic fermentation is to be set up. The grain left after the wort is drawn off is known as "brewers' grains."

It is a very watery material, expensive to carry great distances, and difficult to preserve, being highly fermentable. Since, however, it contains nearly all of the nitrogenous matter of the original grain, with a much smaller percentage of starch, it forms, in spite of its watery condition, a very important cattle-food.

It has heretofore been found difficult to dry it economically, so as to make its preservation and transportation possible. Recently the Pabst Brewing Company of Milwaukee, Wis., have dried the grain at a low temperature by means of a vacuum process, and without the removal of the last traces of wort by pressure.

An analysis shows that out of the 21.50 per cent of proteine, 17.44 per cent consists of true albuminoids. Careful tests showed no traces of sugar left in the grains, and only 3.17 per cent of starch.

In composition it lies, in most respects, between linseed-meal and wheat-bran, save that it has nearly twice as much fibre. Malt sprouts are somewhat more highly nitrogenous, and contain only about half as much fibre, but they contain only one-ninth as much fat, which, in this case, is probably very largely digestible and of high nutritive value.

If placed upon the market at such a price as to compete with other foods of its class, it will undoubtedly, according to Mr. Frear, prove a valuable addition to the list of highly-nitrogenous by-products useful as cattle-foods.

NOTES AND NEWS.

THERE is some difference of opinion as to the original meaning of the word "kangaroo." At the meeting of the Linnean Society of New South Wales on Aug. 27, says *Nature*, the question was discussed, whether, in the dialect of the blacks of the Endeavour River, the word signified "I don't know," and was so used in answer to the queries of Capt. Cook's party, or whether, as Cook supposed, it really was the name of the animal in use among the aborigines of the locality.

—Mr. Cecil Carus-Wilson writes to *Nature* that he has invented a luminous crayon for the purpose of enabling lecturers to draw on the blackboard when the room is darkened for the use of the lantern. He hopes that the invention may prove of value not only to lecturers who use a lantern, but also (in another form) to those students who wish to take notes.

—In a long series of articles a native Japanese paper gives some interesting figures about the students of Tokio (republished in *Nature*). There are 107,812 students in the whole empire in the various colleges and other high schools (primary schools and ordinary middle schools excepted). Of this number, 38,114 represent students prosecuting their studies in the capital; that is to say, about 40 per cent of the whole number are congregated in

Tokio. Among the 38,114 students, 6,899 are domiciled in Tokio, so that the number of those coming from other localities is 31,215. The amounts which individual students spend vary from \$7 or \$8 to about \$15 per month. Taking the average, it may be assumed that each student spends \$10 a month, or \$120 a year. Thus the total amount of money annually disbursed by these lads is a little over \$3,700,000. In other words, money aggregating over three millions and a half is being yearly drawn from the provinces to the capital through this channel. The provinces receive little in return, for few of the students ever go back to their homes, their sole ambition being to remain in the capital, and there rise to eminence in some walk of life.

—Since the preparation of the article by Professor Angelo Heilprin in *Science* of Nov. 7, Mr. Israel C. Russell has made a preliminary report on his researches (in conjunction with Mr. Kerr) in the St. Elias region,—researches undertaken under the auspices of the National Geographic Society. The measurements of Kerr, as reported at length in some of the daily papers, give for the height of St. Elias less than 15,000 feet, which thus places Orizaba pre-eminently to the first place among North American mountains.

—At a meeting of the executive committee of the National Electric Light Association held at the Electric Club, New York City, Nov. 7, the date for holding the thirteenth convention was fixed for Feb. 17, 18, and 19, 1891. Eugene F. Phillips of Providence, where the convention will be held, was appointed chairman of a committee of five, on reception and arrangements, he to appoint the other members of the committee. Gen. C. H. Barney of New York was appointed chairman of a committee of three on electrical exhibits and transportation, he to appoint the other members of the committee. The committee on papers reported the following as promised, and stated that the prospects of securing two or three more important papers are most excellent (announcements of these will be made later): "How can the National Electric Light Association best serve Central Station Interests?" by C. R. Huntley, discussion by A. M. Young; "Distribution of Steam from a Central Station," by F. H. Prentiss, discussion by George H. Babcock; "Distribution and Care of Alternating Currents," by T. Carpenter Smith, discussion by G. H. Blaxter; "Municipal Control of Electric Railroads," by M. W. Mead, discussion by M. J. Francisco; "The Ferranti System," by C. B. Haskins, discussion by C. L. Edgar. The committee has not only secured the promise of these papers, but has gone a step further, and named a person to open the discussion on each paper. This must inevitably tend to bring out the best points of the topic, and to greatly add to the interest in and value of the proceedings.

—If we were to judge by statistics alone, says *Nature* of Oct. 16, we should be forced to conclude that the present system of granting rewards for the destruction of wild animals in India has had little or no effect in diminishing their numbers or in decreasing the mortality caused by them. This conclusion, however, would not be in accordance with facts. The methods according to which the statistics are collected have been so much improved, that no deduction can safely be made from the figures available. This is pointed out in a recent report of the Revenue Department of the Government of Madras. The report continues, "The experience of almost every district officer who has been some years in the country would be that the number of destructive wild animals had largely decreased with the advance of cultivation and the progress of railways, and the evidence of natives would probably be the same. There are parts of the country still, where, owing to the existence of forest and difficulty of access, wild animals of prey continue to exist in large numbers; and it is the case, that, owing to various causes, Europeans, at all events, do less now in the way of killing large game than formerly was the case. They have less time to spare from their official duties, and less money to spend. It can hardly, however, be doubted, that, owing to the existence of the system of granting rewards for animals slain, native shikaris are encouraged to maintain a profession which otherwise probably they would give up from want of support; and for this reason, if for no other, the board would not wish to see at present any change made in the system of granting re-